Fluid Thermal Systems – ENGR 434, Section 01
Abilene Christian University
Fall 2015

Course Description
The purpose of this course is to provide students the skills needed for analysis, modeling and design of thermal systems. The course involves applications of fluid mechanics, thermodynamics and heat transfer. Students will complete a significant engineering project involving the design of a thermal or energy system. Consideration will be taken with regard to realistic engineering constraints, selection of components, modeling and simulation of system components, and a life cycle analysis that may encountered as practicing engineers. ***Prerequisites: ENGR 333 and ENGR 481. Credit hours: 3.***

Class Meeting Times and Location
This class meets Tuesday and Thursday from 8:00 a.m. to 9:30 a.m. in Foster Science Building 350. The final is scheduled for December 9th from 8:00 a.m. to 9:45a.m. in Foster Science Building room 350.

Required Text
The required text for this course is *Design of Fluid Thermal Systems,* 4th, by William S. Janna, Cengage Learning, 2015, ISBN 978-1-285-85965-1.

Intended Audience
This is an elective course for engineering majors interested in mechanical engineering topics. It is intended to be completed during the senior year. Competency in Fluid Mechanics, Heat and Mass Transfer, and Thermodynamics are required to succeed in this course.

Catalog Description
Design and optimization of thermal systems with real world constraints, as well as economic and design analysis. A formal technical written report and oral presentation are required.

Contact Information

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The mission of ACU
To educate students for Christian service and leadership throughout the world.

The mission of the College of Arts and Sciences
The College of Arts and Sciences engages students with humanity's greatest ideas to create understanding, apply insights, and serve the world as Christian thinkers and problem solvers.

The mission of the Engineering and Physics Department
The ACU engineering program strongly supports the university's mission of educating students for Christian service and leadership throughout the world. In support of this mission, ACU engineering graduates will attain:

-A deep and broad understanding of engineering principles and practices as evidenced by professional employment, continued professional development, and graduate study in engineering or other professional fields.
- An extensive knowledge of the innovative design systems unique to engineering professionals as demonstrated by using critical thinking skills to contribute to the scientific and technical literature, patents and intellectual property, professional societies, and creative designs.
-A thorough understanding of Christian service and leadership as shown in their commitments to professionalism, ethics, and service and leadership within the engineering profession, the church, and society.

Teaching Philosophy

Engineering and physics are well respected professions. The public places great trust in these professionals being honest, competent, and ethical. Many codes of ethics for these fields indicate that the commitment to protecting the health, safety, and welfare of the public is of paramount importance. These values are in harmony with Christian principles and ideals. Christian engineers should be honest (Matthew 5:37), work hard to ensure competency (Colossians 3:23), and put the public's interest ahead of his or her own (Luke 6:31). In light of these principles, this course will be taught such that you will gain an appreciation for the professional nature of engineering and physics. It will be taught so as to give you every opportunity to begin to develop competency in these fields. This will require reading assignments, homework, quizzes, tests, and group discussion. The instructor especially encourages the discussion of topics that would bear on integrating faith and professional responsibilities (cheating on licensure exams, weapons design and manufacture, environmental laws and employment opportunities in developing nations, etc.).

Learning Objectives

The activities of the course support the assessment of the following ABET Outcomes:

Criterion 3

3(b) an ability to design and conduct experiments, as well as to analyze and interpret data
3(e) an ability to identify, formulate and solve engineering problems
3(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

ABET Competencies and Measurements

ABET Learning Objectives	Course Competencies	Measurement
3(b) an ability to design and conduct experiments, as well as to analyze and interpret data	Apply design processes and procedures to design thermal systems.	Daily homework, weekly quizzes, exams 1 and 2, project, final exam.
	Develop and compute economic analysis for individual system components as well as life cycle analysis.	Daily homework, Exam 2, project.
3(e) an ability to identify, formulate and solve engineering problems	Apply mathematical knowledge in design of thermal systems.	Daily homework, weekly quizzes, exam 2, project, and final exam.
3(k) an ability to use the techniques, skills, and modern	Select and size components for thermal process design	Daily homework, weekly quizzes, exam 2, project, and

engineering tools necessary for engineering practice	based on engineering specifications.	final exam.

Course Policies

Academic Integrity

Academic integrity is defined as academic work completed as assigned for each class by the individual or group responsible for the work. Violations of academic integrity and other forms of cheating involve the intention to deceive, mislead, or misrepresent and therefore, are a form of lying. Such actions are contrary to behavioral norms that flow from the nature of God. Academic misconduct includes, but is not limited to, the following: 1) Failing to give credit to sources used in a work in an attempt to present the work as one's own, 2) Submitting papers or projects obtained from another source (e.g., research service or club paper file) as one's own, 3) Falsifying information orally or in writing, and 4) Receiving, giving, or using unauthorized aid on an examination or quiz. An example of academic misconduct specific to this course might be copying an instructor's solution while their back is turned and then sharing the solution with classmates. All parties involved would be guilty of misconduct. Academic misconduct may result in, but is not limited to, a zero on the assignment and/or an F in the course. Additionally, the department chair, Dean of the College of Arts and Sciences, and the Dean of Student Life will be notified. See the full university policy, including how to appeal a decision, by following this link: http://www.acu.edu/academics/provost/policies/index.html.

Attendance Policy

Attendance is expected at all class sessions. It is also expected that you arrive promptly. If you are absent or tardy it will negatively affect your homework and quiz grades. Typically, classes will involve the presentation and discussion of new material, discussion of textual reading assignments, or the consideration of problems to solve. Occasionally during class, students will work in small groups to solve problems. You are required to attend at least 80% of class meetings in order to receive credit for the course. For TR classes, you cannot miss more than 6 times regardless of the reason. If you miss more than 20% of the classes, you will be dropped from the class with a WF. This grade averages in your GPA as an F.

If you are absent from class, it is your responsibility to get the lecture notes and class assignments before the next class meeting.

Course Assignments	Due Date*	Weight
Homework Unless notified to the contrary, you are highly encouraged to work together on the homework assignments. When working together students should not copy one another's answers, but help guide and teach one another when one student understands a concept more clearly. Homework will be assigned at each meeting (with the exception of exam days) and due at the beginning of class the following meeting. Homework is due at the beginning of class on the due date and must be submitted in person. To get full credit, the homework must be completed on engineering computation paper and turned in on time. Additionally, all work in the solution process (including units) shall be documented in a neat and logically arranged manner, clearly show the final answer with the correct units. Late homework will not be graded (if you only have part of it done, turn in what you have done on time). *Homework problem solving approach:*	**Weekly**	**25%**

1. Restate the problem and sketch the system 2. Identify the given information 3. Identify the governing equations and state assumptions 4. Solve for unknowns and calculate results 5. Discuss the results		
Quizzes A total of 12 quizzes will be given, typically at the beginning of class (note none will be given on exam weeks). Thus, it is important that you be in class and on time to complete the quiz. No makeup quizzes will be given except in the rare circumstances of pre-approved absences. However, the lowest quiz grade will be dropped in calculating the quiz portion of your final grade. Quiz material will cover previous lecture material, recent homework assignments and/or the text reading assignment for that day. All assignments, quizzes, and exams are considered to be comprehensive. That is, it will be likely that you will need to sufficiently know and understand previously covered material to adequately solve currently covered problems on quizzes or exams. No unauthorized help may be given or received on the quizzes.	**Tuesdays beginning Week 2**	**5%**
Project(s) A significant portion of the course is a major analysis/design project(s). Teams of students will work on assigned project to develop a final design report. The report will contain the design methodology as well as the design calculations and cost estimate.		**20%**
Regular Exams (2 @ 15%,) Two regular exams and one final exam will be given during the semester. All exams are comprehensive and will emphasize problem solving both qualitatively and quantitatively. Calculators may be used during the exams, however only NCEES approved calculators will be permitted during tests. This is to help you begin preparing for the FE exam. If you are caught using a non-approved calculator, your test will be collected and your grade will be a zero. The approved calculators include the following: • Hewlett Packard – HP 33s, HP 35s, and no other • Casio – All FX-115 models. Any Casio calculator must contain FX-115 in its model name. • Texas Instruments – All TI-30X and TI 36X models. Any TI calculator most contain either TI-30X or TI-36X in its model name. • If you are unsure about your calculator, it is your responsibility to check with the instructor for approval. Exams will likely be closed book and no unauthorized help may be given or received on the exams.		**30%**
Final Exam The final exam will be comprehensive in nature including any new material covered after the third exam. *Exams may not be taken late without preapproval.*	**December 9th from 8:00 a.m. to 9:45 a.m.**	**20%**

Calculation of Final Course Grade*

The grading scale will be as follows:

90% and above . . . . . A
80% - 89% . . . . . B
70% - 79% C
60% - 69% . . . . . D
59% and below . . . . . F

*Instructor reserves the right to decrease the lower bound of the grade cut-offs.

ADA Compliance Statement

"Abilene Christian University is dedicated to removing barriers and opening access for students with disabilities in compliance with ADA and Section 504 of the Rehabilitation Act. The Alpha Scholars Program facilitates disability accommodations in cooperation with instructors. In order to receive accommodations, you must be registered with Alpha Scholars Program, and you must complete a specific request for each class in which you need accommodations. If you have a documented disability and wish to discuss academic accommodations, please call our office directly at 325-674-2667."

Tentative Course Schedule

While every effort will be made to closely follow this schedule, there may be a need to deviate from it. The instructor reserves the right to alter this schedule to best achieve the objectives of the class.

Assignments may vary from that presented below, but will be similar in content, number, and frequency.

Date	**Week**	**Sections**	**Topics and Events**
August 25, 27	1	Ch. 1	Engineering Design Process, Introduction to Design of Thermal Systems
September 1,3	2	Ch. 2	Fluid Properties and Basic Equations
September 8, 10	3	Ch. 3	Piping systems
September 15, 17	4	Ch.4	Piping systems
September 22, 24	5	Ch. 5	Unsteady Flow, Flow measurement
September 29, October 1	6	Ch. 6	Pumps, pumping systems, pump selection
October 6, 8	7	Ch. 7	Exam 1, Heat Transfer Fundamentals
October 13, 15	8	Ch. 7	Heat Transfer Fundamentals
October 20, 27		Ch. 8	Double Pipe Heat Exchangers
November 3, 5	9	Ch. 9	Shell and Tube Heat Exchangers
November 10, 12	10	Ch. 10	Plate and Frame Heat Exchangers
November 17, 19	11	Ch. 10	**Exam 2,** Cross Flow Heat Exchangers
November 24, 26	12	Handouts	Engineering Standards, Codes, Specifications, **Thanksgiving Break**
December 1, 3	13		**Final Project Report Due, Oral Presentations**
December 9	14		**Final Exam**